Tonkin+Taylor

Memo

To:	**William Woods, Jenni Austin**	**Job No:**	**85452.012**
From:	**Richard Reinen-Hamill**	**Date:**	**31 May 2016**
Subject:	**CentrePort Harbour Deepening Project - Comments on community queries**		
cc:			

1 Purpose

This memo sets out our response to issues raised at and after Seatoun community consultation sessions held on and 5 and 21 May 2016. The queries are summarised in italics below, with our response.

2 Questions and responses

What is the "worst case" prediction for erosion of the beach in the vicinity of the Hector street car park and the playground ...(a) on average...and (b) following storm surges?

The existing fluctuation of the beach is illustrated in the Google Earth images included in Figure 4-4 and 4-5 in our report. These photographs show an envelope of beach movement in the order of 30 m at the southern end of the beach. From our analysis, sediment is moved along the beach (i.e. the bulge moves or flattens along the shoreline), so while one area erodes another area accretes. This fluctuation is due to the bi-modal wave climate; the bulge moves southwards with northerly wind generated waves from the harbour and northward with southerly swells.

a) On average

The wave roses in Appendix C of our report show that at site P15 (offshore from the area of interest) the peak energy for the typical wave climate (i.e. on average) moves from around 112.5 degrees to 135 degrees as a result of the channel deepening. This means that wave energy becomes more southerly with the dredged channel (refer Figure 1).

The following figures show the change in wave height from the 5 m depth contour to the shoreline in the area of interest for a 0.9 m wave due to breaking, shoaling and refraction from the Unibest-LT model for both a 112.5 and a 135 degree incident wave direction. This wave height represents the 95% of wave heights at this location and represents a significant storm event. With an incident direction of 112.5 degrees (Figure 2) the wave height at the coast is around 0.9 m and has an angle of around 20 degrees to the shoreline. With the increased angle from the coast due to the Project, increased refraction effects reduce the average wave height to around 0.6 m at an angle of 20 degrees to the shoreline (Figure 3). These results, and the wave rose at P15, suggest that with the Project there will be more refracted wave energy at this location (i.e. lower average wave heights during southerly conditions).

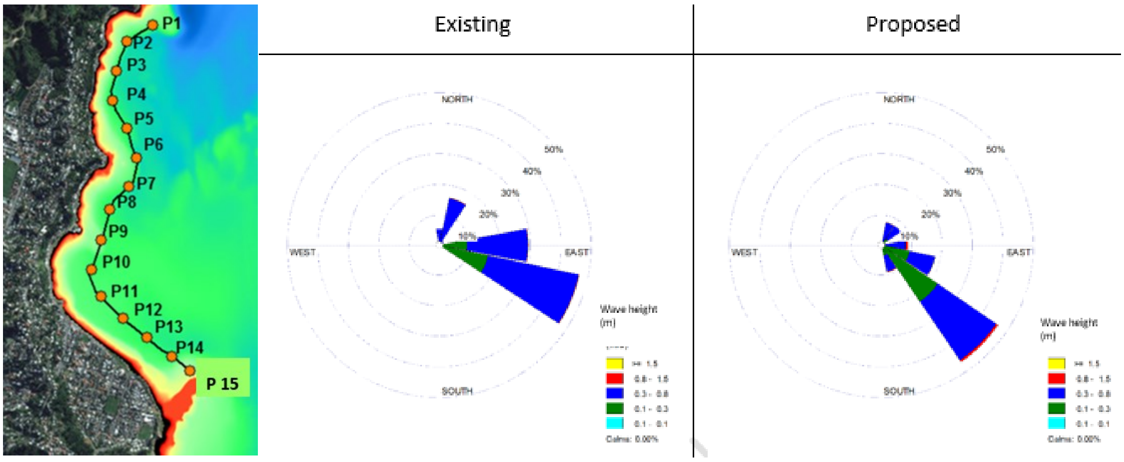


Figure 1 Wave roses for P15 and location of p15

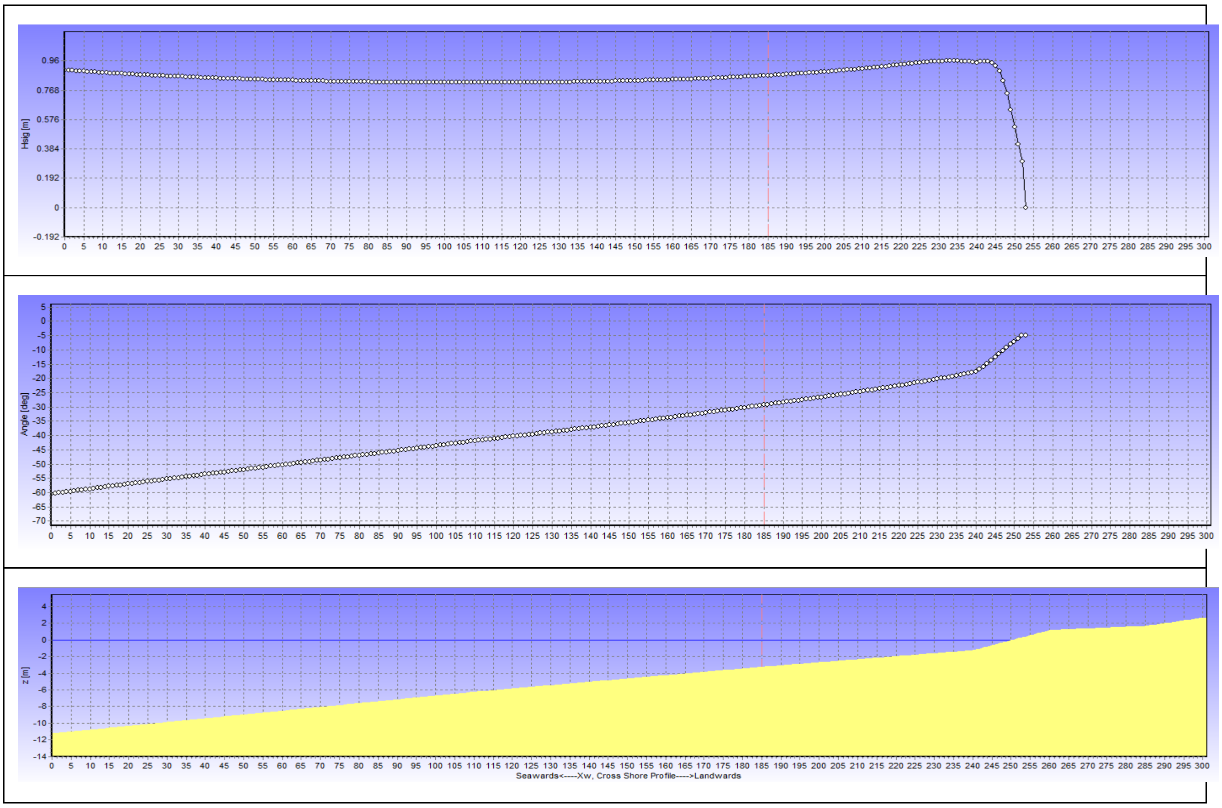
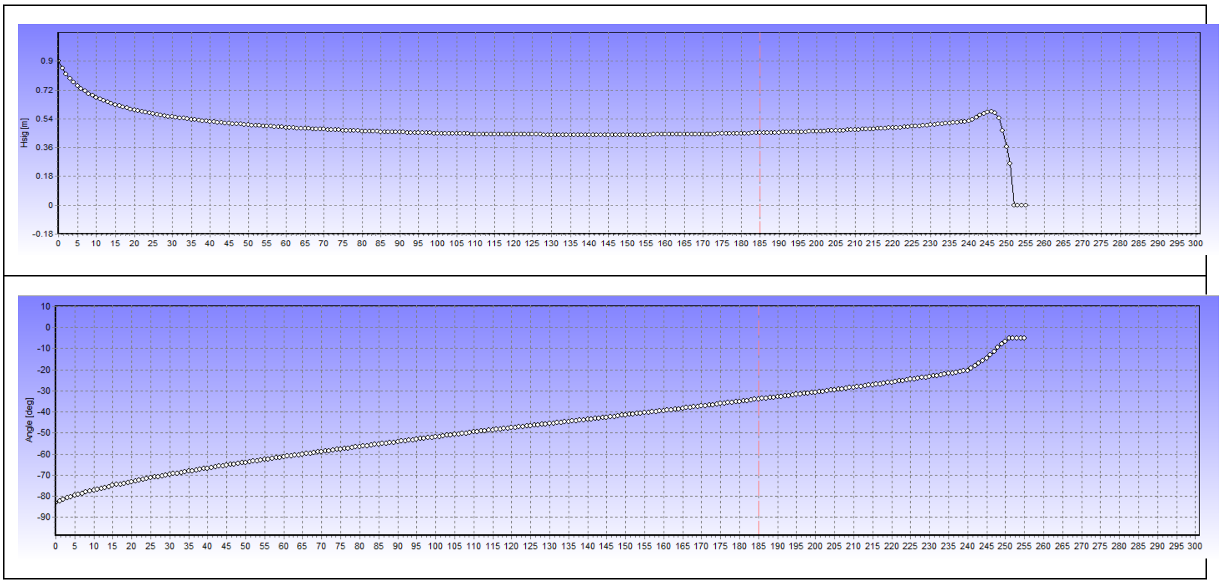


Figure 2 0.9 m wave from 112.5 degrees approaching beach near Hector Street car park (existing situation) showing change in wave height (top box) and wave angle (middle box) as it moves along the beach profile (lower box). Sediment transport occurs at this location from 185 m to the coast (red dashed line).



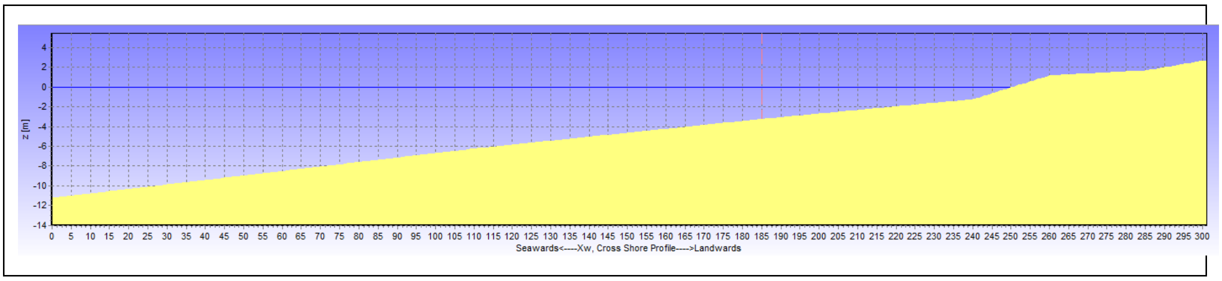


Figure 3 0.9 m wave from 132 degrees approaching beach near Hector Street car park (with channel deepening)

(b) following storm surges

During storm events this location is partially sheltered from southerly swells due to the reef and Steeple Rock. However, as show in in Figure 1, the refraction effects resulting from the dredged channel increase wave energy from 112.5 to 132 degrees during peak storm events. This is shown by the spectral wave analysis included in Appendix A to this memo for a 1.7 m significant wave height with a period of 11 seconds and a direction of 170 degrees for the existing and proposed channel situation. This provides a nearshore wave height in the order of 0.9 m at P15. Wave energy is largely directed onshore during these events due to early refraction with the longer wave periods. This will result in erosion scarps occurring more frequently at the upper part of the beach profile at the area of interest and is likely to increase run-up and overtopping over the beach crest, depending on the state of the beach prior to the storm. It is likely that there may be more frequent inundation of the backshore area as a result of the Project.

This part of the beach is not protected by a sea wall and we have had sea water overtopping into the car park on at least one occasion in the last 15 years.

(a) What is the prediction of the effects of the proposal in terms of increased wave level height in this area in SE storm surges?

As discussed above it is likely that there may be more frequent inundation of the backshore area when significant southerly storms occur at high tide levels.

(b) What is the prediction of the effects of the proposal in terms of increased wave level height in this area in non-local generated Tsunamis? (those entering the harbour from offshore events)

While the potential effects of the dredge channel on tsunami has not been modelled, it is anticipated that the present modelling carried out by GNS (2014) provides a conservative assessment of the likely effects of tsunami propagation due to their modelling considering the event occurring at Mean High Water Springs rather than mean sea level. GNS's modelling indicates tsunami inundation along Seatoun of 2 to 3 m for a significant Wairarapa Fault slip and more than 6 m for a significant Hikurangi Trench slip. At these levels there are already significant inundation and damage likelihoods along Seatoun.

What will be the effect of sea level rise in relation to the above predictions in 35 years?

We have modelled the alongshore transport changes using Unibest-LT for a 0.3 m increase in sea level rise at the five locations used in our report. This was done by increasing the mean sea level but keeping all other parameters the same (i.e. same wave climate and beach profile). The results with and without the dredged channel for present day and with 0.3 m sea level rise are included in Table 1 below.

Table 1 change in equilibrium coast angle and transport capacity with the Project and with 0.3 m sea level rise

		Present day					With 0.3 m SLR			
		Existing			Proposed		Existing		Proposed	
Location	Wave climate	Coast angle	Equil. Coast angle	Transport (m3/yr)	Equil. Coast angle	Transport (m3/yr)	Equil. Coast angle	Transport (m3/yr)	Equil. Coast angle	Transport (m3/yr)
Scorching Bay	P02	139	-3.95	-4,272	0.38	826	-4.11	-4,175	0.39	795
Worser Bay	P10	126	-1.73	-679	-3.99	-3,279	-1.98	-1,002	-4.22	-4,627
Seatoun (North)	P11	47	8.26	2,759	-4.78	-1,635	8.45	2,627	-5.29	-1,662
Seatoun (Central)	P13	36.5	-9.99	-3,920	-3.10	-769	-10.59	-3,943	-2.72	-626
Seatoun (South)	P15	52	-12.49	-6,669	-17.97	-25,515	-18.73	-25,524	-17.97	-25,515

The results show that with sea level rise the alongshore transport rates change from the present day condition. The most significant change is at Seatoun (South) where transport rates increase from around -6,700 m^3/yr from present day to -25,500 m^3/yr. This increases the alongshore drift potential to the north and is likely to result in erosion pressure at the southern end of the system (at Hector Street).

Comparing both sea level rise and the dredged channel effect (as shown in Table 1) with the existing situation shows alongshore drift at Scorching Bay reduces (transport changes from -4,272 to 795 m^3/yr). At Worser Bay the trend of northerly transport is increased (from -679 yo 04627 m^3/yr) within the cell meaning sand is more frequently at the northern end of the embayment. Along Seatoun there are small variations with changes in net transport potential. At Seatoun North net transports change from 2,759 to -1,662 m^3/yr) while at Seatoun Central northerly transports reduce from -3920 to -626 m3/yr. At Seatoun south the transport trends with sea-level rise increases to -25,515 m^3/yr, which is similar to the expected change with sea level rise and no channel dredging (25,524 m^3/yr).

The dredged channel is predicted to result in similar effects at Seatoun (South) as is expected to occur with 0.3 m of sea level rise while at other locations the effect of the dredged channel and sea level rise results in less change. Therefore, the channel dredging is likely to accelerate change at Seatoun South but result in similar changes as would occur with 0.3 m of sea level rise. At the other locations the combined effect of channel dredging and sea level rise is similar to the effect of channel dredging as discussed in Section 4.3 of our report.

I understand that the proposed "adaptive management" includes maintaining the existing sea wall at the Fort Dorset end. What adaptive management is proposed for the area between where that sea wall currently finishes to Marine Parade?

There is no proposed adaptive management change in this area as predicted changes are likely to be within the existing fluctuation and movement of the beach systems.

Is there any proposal to (if necessary) build a sea wall or rock protection in front of number 1 Hector street and/or the car park?

Yes. There is a proposal to monitor the situation and if necessary to extend the existing seawall some 35 m to the north in front of 1 Hector Street. However, there is no proposal to extend the existing seawall towards the Hector Street car park (refer Figure 4-4) as the beach system is considered sufficiently wide at this location so as not to result in erosion to the landward areas..

What will the effect of the project be on flooding in the area of the Hector Street car parking lot – there has been flooding here in the past, what can be done to alleviate this?

There may be a potential for increased overtopping frequency and flow at this location during southerly storms due to more frequent beach narrowing during southerly events. Overtopping flows could be restricted by topographic changes within the grass reserve areas in the form of low grass mounds and contouring to prevent wave overwash. It is noted that this is likely to require consideration of catchment flows to prevent ponding during rainfall events if the bunds are continuous. However, it may be possible to reduce overtopping with contour changes, but leaving a gap where the beach access ramp is adjacent to the boat sheds. This could result in localised overtopping at this location, but the volume would be limited due to the width of the gap.

31-May-16
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Attachment – CG wave output for 1.7 m significant wave height, 11 second period from 170 degrees

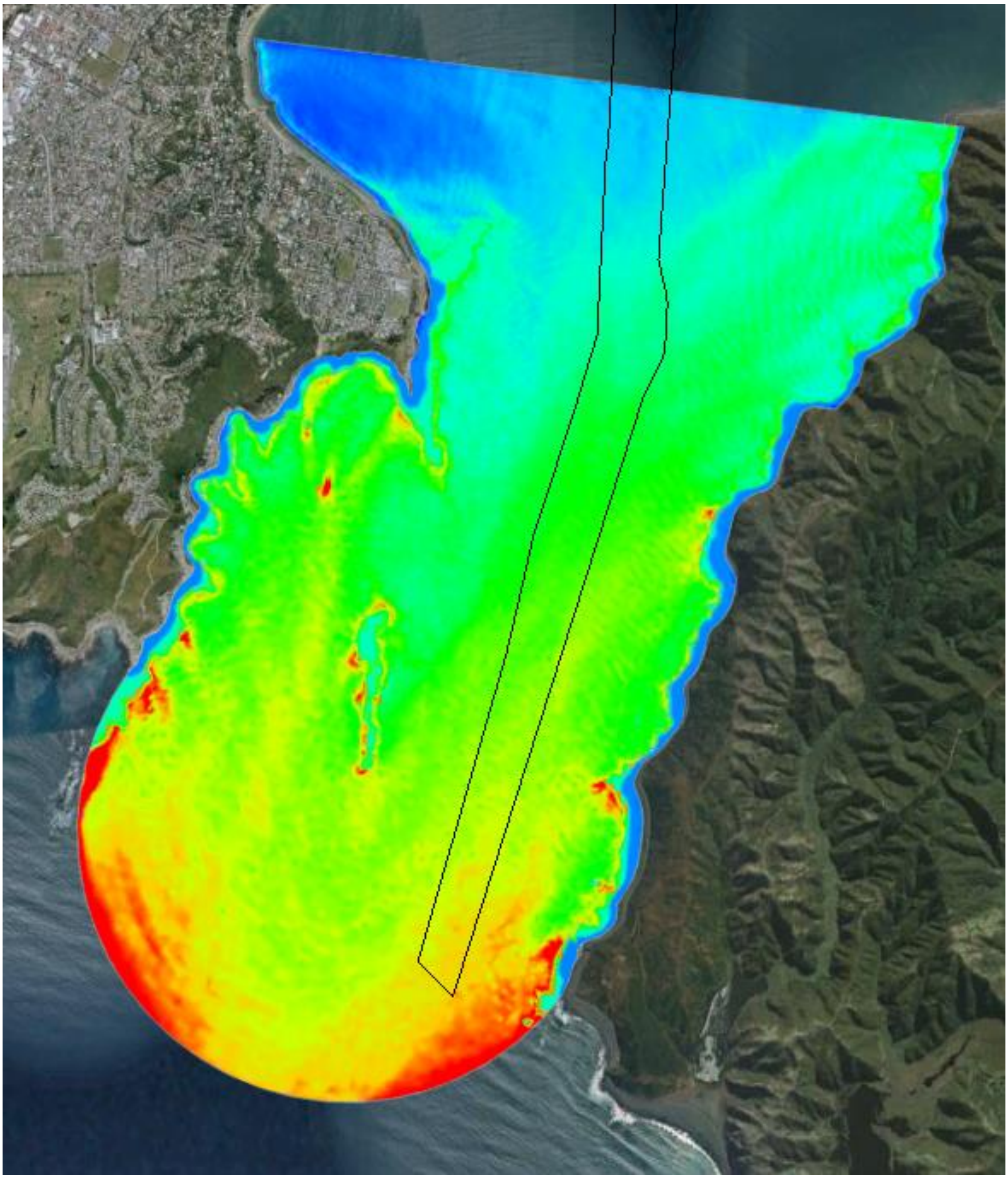

Figure A1 - Existing situation using CG Wave. Wave at southern boundary 1.7 m (Hs) with 11 second period from 170 degrees

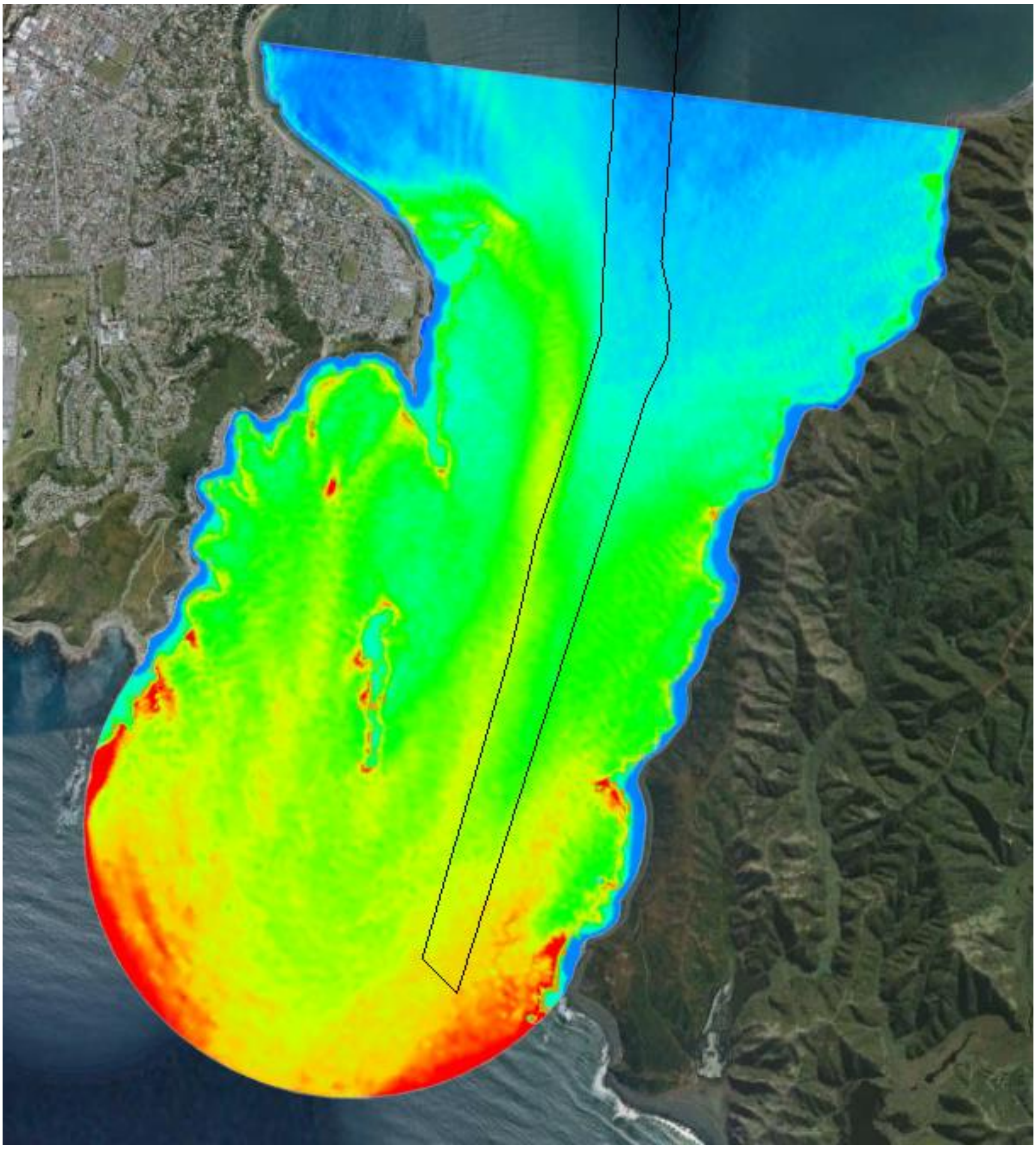

Figure A2 - Dredged channel situation using CG Wave. Wave at southern boundary 1.7 m (Hs) with 11 second period from 170 degrees. Higher waves evident along western edge of channel and off Steeple Point

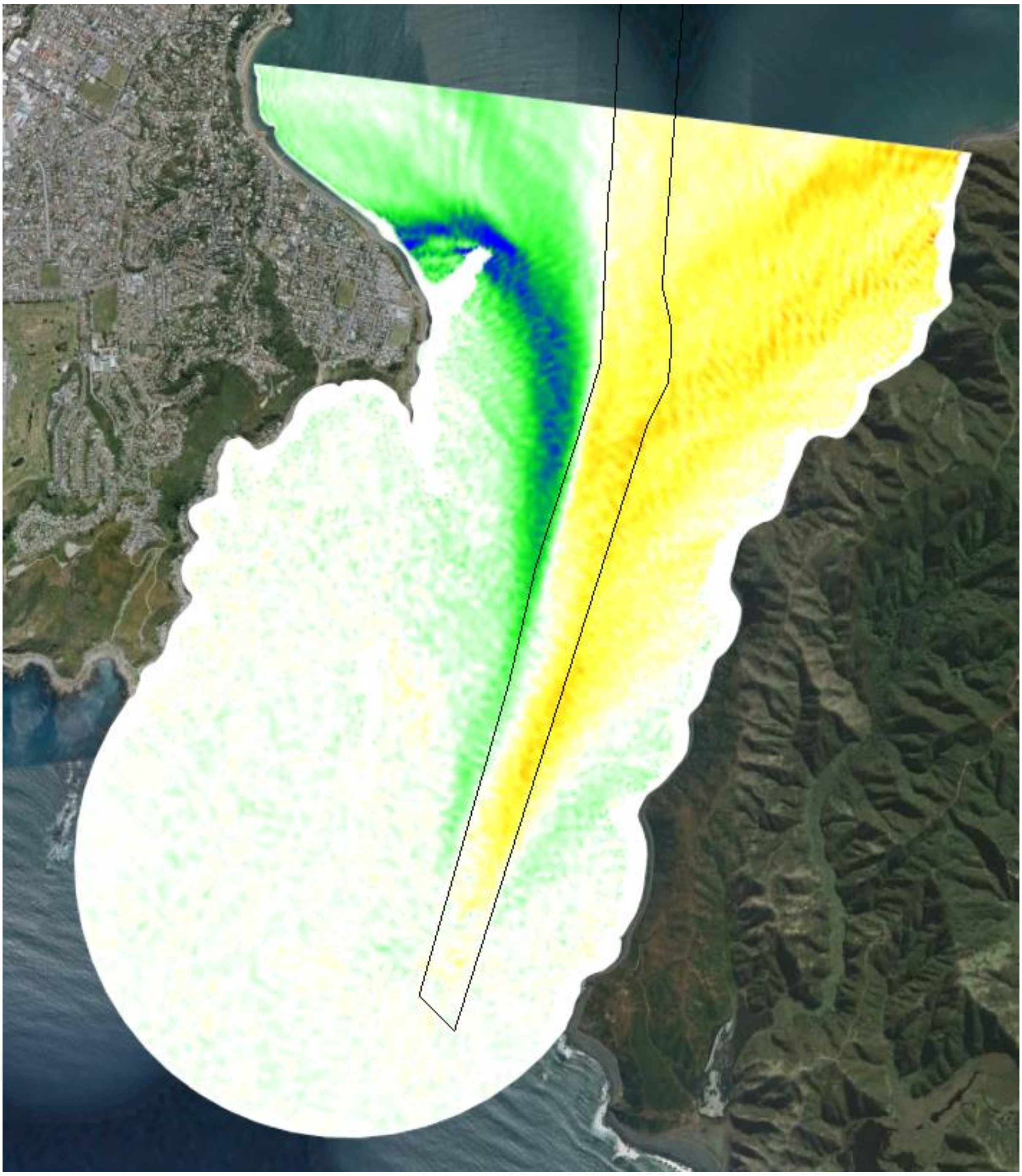

Figure A3: Absolute change in wave height from existing to channel dredge option. Blue indicated 0.5 m increase in wave height and dark yellow 0.5 m decrease in wave height.